PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-133476**
(43)Date of publication of application : **21.05.1999**

(51)Int.Cl. **G03B 7/16**
G03B 7/08
G03B 7/28
H04N 5/765
H04N 5/781

(21)Application number : **09-297564**
(22)Date of filing : **29.10.1997**

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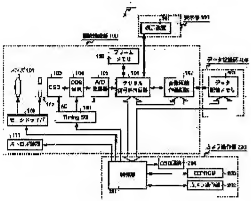
(54) **IMAGE PICKUP DEVICE**



(57)Abstract:
PROBLEM TO BE SOLVED: To provide an image pickup device capable of properly reproducing white, even if the color temp. of a flash is changed, in the case a stroboscope device flashes, so as to execute photographing.
SOLUTION: Relating to this digital camera 1, in a strobe-photographing mode, a control part 201 measures the energization time of a strobe light emitting tube flashing of the stroboscope device 111, calculates a variation in voltage applied to the strobe light emitting tube, based on the energization time, to calculate the shifting amount of the color temp. of the flash and further, an AWB control value, based on the calculated shifting amount of the color temp. of the flash and an AWB(automatic white balance) evaluation value and sets the gain of a white balance adjusting part of a digital signal processing circuit 106, to adjust a while balance, based on the AWB control value.

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]An imaging device comprising provided with speed-light-photography mode which takes a photograph by emitting a flash with a strobe device:
An image sensor which changes object light through an optical system into an electrical signal, and is outputted as a color picture signal.
AWB evaluation methods which output luminance data of each color of said color picture signal as AWB evaluation value.
A white balance adjustment means to perform white balance adjustment of at least 2 colors of said color picture signal.
In a color temperature calculating means which computes a shift amount of a color temperature of said flash in said speed-light-photography mode, and said speed-light-photography mode, A white balance control means which computes an AWB control value based on a shift amount and said AWB evaluation value of a color temperature of said computed flash, controls said white balance adjustment means based on the AWB control value concerned, and performs white balance adjustment.

[Claim 2]The imaging device according to claim 1, wherein said color temperature calculating means measures time energized in a strobe light pipe which emits a flash of said strobe device, computes the amount of changes of potential impressed to the strobe light pipe concerned based on the energized time concerned and computes a shift amount of a color temperature of said flash.
[Claim 3]Said color temperature calculating means measures voltage between both ends of a strobe light pipe which emits a flash of said strobe device at the time of a luminescence start and an end of luminescence, The imaging device according to claim 1 characterized by computing a shift amount of a color temperature of said flash based on a difference of voltage between both ends at the time of the measured luminescence start concerned and an end of luminescence.
[Claim 4]The imaging device according to claim 1, wherein said color temperature calculating means measures distance to a photographic subject, decides on strobe light time of said strobe device based on the measured object distance concerned and computes a shift amount of a color temperature of said flash based on the strobe light time concerned.
[Claim 5]Said color temperature calculating means before luminescence of a flash for photography to said strobe device, The imaging device according to claim 1 making Puri luminescence perform, deciding on strobe light time in the case of photography from quantity of catoptric light in the case of the Puri luminescence concerned, and computing a shift amount of a color temperature of said flash based on the strobe light time concerned.

[Claim 6]An imaging device of any one statement of claim 1-5, wherein said white balance adjustment means adjusts a gain of said color picture signal and said white balance control means sets up said gain based on said AWB control value.
[Claim 7]An imaging device of any one statement of claim 1-5, wherein said strobe device can set up arbitrarily voltage between both terminals of a strobe light pipe.
[Claim 8]Have a memory measure which memorizes a strobe light pipe characteristics table showing relation between voltage between both ends of said strobe light pipe, and luminescent color temperature, and said white balance control means, An imaging device of any one statement of claim 1-5 performing white balance adjustment with reference to said strobe light pipe characteristics table.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the imaging device provided with the white balance adjustment function in detail about an imaging device.
[0002]
[Description of the Prior Art]In the digital camera, irrespective of the color temperature of light, white balance adjustment is performed so that color reproduction of the white photographic subject may be carried out white. In this case, generally, the digital camera provided with the strobe device is constituted so that white balance adjustment at the time of speed light photography (strobe light) may be performed based on the color temperature of a strobe light.
[0003]For example, when a xenon tube is used for the light-emitting part of a strobe device, in order to prevent that color reproduction of the white photographic subject is inclined and carried out to the blue side by the strobe light at the time of speed light photography, blue is stopped in the whole picture, and white balance adjustment is performed so that red may be emphasized.
[0004]However, in such white balance adjustment, in speed light photography, when the color temperature of outdoor daylight differs from the color temperature of a strobe light, an unnatural color may be reproduced by the photoed picture.
[0005]Namely, a short distance serves as a color temperature of a strobe light, a long distance serves as a color temperature of outdoor daylight, in speed light photography,

since a strobe light arrives only to a predetermined distance, if white balance adjustment is performed based on the color temperature of a strobe light, color reproduction of the picture of a short distance will be carried out properly, but. It becomes difficult to carry out color reproduction of the long-distance picture properly.
[0006]Conversely, if white balance adjustment is performed according to outdoor daylight, color reproduction of the long-distance picture will be carried out properly, but it becomes difficult to carry out color reproduction of the picture of a short distance properly.
[0007]In view of the above-mentioned problem, there are some which were indicated to JP,7-301842,A in speed light photography, for example as an electronic "still" camera for carrying out color reproduction of the photoed picture properly.
[0008]The electronic "still" camera indicated to this JP,7-301842,A, A strobe device provided with the image pick-up part provided with the solid state image pickup device, and the light-emitting part which emits a flash, The white balance adjustment circuit which performs white balance adjustment of the picture signal from an image pick-up part based on the color temperature of a flash, and the color temperature of the light from a photographic subject when not emitting a flash, In the electronic "still" camera which it had, the distance detecting means which detects the distance to a photographic subject a distance detecting means, The field on a photography screen is divided into plurality, the distance to a photographic subject is detected for every screen separation of that, and when emitting a flash with a strobe device and taking a photograph, the white balance adjustment circuit is constituted according to the distance to a photographic subject so that white balance adjustment may be performed for every split screen, respectively.
[0009]
[Problem(s) to be Solved by the Invention]However, since the luminescent color of a stroboscope changes with the terminal voltage of a strobe light pipe, when luminescent color temperature has high voltage, it becomes high color temperature (blue system), and when voltage is low, there is a problem of being low color temperature (red system).
[0010]In the electronic "still" camera indicated to above-mentioned JP,7-301842,A, although control of AWB at the time of a strobe light has weight averaged the AWB control value when not carrying out a strobe light, and the AWB control value at the time only of a strobe light using distance measurement data etc., The color temperature of a strobe light itself shifts with the voltage between strobe light edge-of-a-winding-instrument children, and there is a problem that a proper picture cannot be acquired, at the time of speed light photography.
[0011]In light of the above-mentioned problems, this invention is a thing.
When taking a photograph by being alike and emitting a flash more, the purpose is to provide the imaging device which can reproduce white properly, even if the color temperature of a flash changes.

[0012]
[Means for Solving the Problem]In order to solve SUBJECT mentioned above and to attain the purpose, an imaging device concerning claim 1, In an imaging device provided with speed-light-photography mode which takes a photograph by emitting a flash with a strobe device, An image sensor which changes object light through an optical system into an electrical signal, and is outputted as a color picture signal, AWB evaluation methods

which output luminance data of each color of said color picture signal as AWB evaluation value, A white balance adjustment means to perform white balance adjustment of at least 2 colors of said color picture signal, In a color temperature calculating means which computes a shift amount of a color temperature of said flash in said speed-light-photography mode, and said speed-light-photography mode, An AWB control value is computed based on a shift amount and said AWB evaluation value of a color temperature of said computed flash, and it has a white balance control means which controls said white balance adjustment means based on the AWB control value concerned, and performs white balance adjustment.

[0013]In an imaging device concerning claim 1, an imaging device concerning claim 2 said color temperature calculating means, Time energized in a strobe light pipe which emits a flash of said strobe device is measured, the amount of changes of potential impressed to the strobe light pipe concerned is computed based on the energized time concerned, and a shift amount of a color temperature of said flash is computed.

[0014]In an imaging device concerning claim 1, an imaging device concerning claim 3 said color temperature calculating means, Voltage between both ends of a strobe light pipe which emits a flash of said strobe device at the time of a luminescence start and an end of luminescence is measured, and a shift amount of a color temperature of said flash is computed based on a difference of voltage between both ends at the time of the measured luminescence start concerned and an end of luminescence.

[0015]In an imaging device concerning claim 1, an imaging device concerning claim 4 said color temperature calculating means, Distance to a photographic subject is measured, it decides on strobe light time of said strobe device based on the measured object distance concerned, and a shift amount of a color temperature of said flash is computed based on the strobe light time concerned.

[0016]In an imaging device concerning claim 1, an imaging device concerning claim 5 said color temperature calculating means, To said strobe device, before luminescence of a flash for photography, Puri luminescence is made to perform, it decides on strobe light time in the case of photography from quantity of catoptric light in the case of the Puri luminescence concerned, and a shift amount of a color temperature of said flash is computed based on the strobe light time concerned.

[0017]As for said white balance adjustment means, an imaging device concerning claim 6 adjusts a gain of said color picture signal in an imaging device of any one statement of claim 1-5, and said white balance control means sets up said gain based on said AWB control value.

[0018]An imaging device concerning claim 7 presupposed said strobe device that voltage between both terminals of a strobe light pipe can be set up arbitrarily in an imaging device of any one statement of claim 1-5.

[0019]In an imaging device of any one statement of claim 1-5 an imaging device concerning claim 8, Having a memory measure which memorizes a strobe light pipe characteristics table showing relation between voltage between both ends of said strobe light pipe, and luminescent color temperature, said white balance control means performs white balance adjustment with reference to said strobe light pipe characteristics table.

[0020]

[Embodiment of the Invention]With reference to an accompanying drawing, the suitable embodiment of the digital camera which applied the imaging device concerning this

invention is described in detail below.
[0021][Outline of this invention] When taking a photograph in speed-light-photography mode (mode which takes a photograph by emitting a flash), the imaging device concerning this invention computes an AWB control value based on AWB evaluation value and the shift amount of the color temperature of a flash, and adjusts a white balance based on this AWB control value.
[0022]Hereafter, the adjustment method (embodiment 1) of a white balance when the strobe device has determined strobe light time, and the adjustment method (embodiment 2) of the white balance in the case of having decided on strobe light time by CPU of a control circuit are explained, respectively.
[0023](Embodiment 1) Drawing 1 is a lineblock diagram of the digital camera concerning Embodiment 1. In the figure, 1 shows the digital camera and this digital camera 1 is ** constituted with the picture image pick-up part 100, the camera operation part 200, the indicator 300, and the data recording part 400.
[0024]The picture image pick-up part 100, The lens 101, auto-focusing, etc. It has the included mechanism mechanism 102, CCD103, CDS circuit 104, A/D converter 105, the digital signal processing circuit 106, the graphical-data-compression signal circuit 107, the frame memory 108, Motor Driver 109, TimingSG(control signal generation)110, and the strobe device 111. The camera operation part 200 is provided with the control section 201, the camera operation part 202, EEPROM203, and OSD circuit 204. The indicator 300 comprises the display 301 and the data recording part 400 comprises the data storage memory 401.
[0025]A lens unit consists of mechanism mechanism 102 grade containing the lens 101, and auto-focusing (AF), a diaphragm and a filter part, and the mechanical shutter of the mechanism mechanism 102 performs simultaneous exposure of the two fields. CCD(charge coupled device) 103 changes into an electrical signal (analog image data) the image inputted via the lens unit. The CDS (correlation double sampling) circuit 104 is a circuit for low-noise-izing to a CCD type image sensor.
[0026]A/D converter 105 changes into digital image data the analog image data from CCD103 inputted via CDS circuit 104. That is, the output signal of CCD103 is changed into a digital signal by A/D converter 105 via CDS circuit 104 in the optimal sampling frequency (for example, integral multiple of the subcarrier frequency of an NTSC signal). The frame memory 108 is a buffer which stores digital image data temporarily.
[0027]The digital signal processing part 106 is provided with the white balance adjustment part which adjusts the gain of R and G to digital image data, and divides the digital image data after white balance adjustment into color difference (Cb, Cr) and luminosity (Y), and performs various processing. The digital signal processing part 106 is outputted to the control section 201 by making each luminance data of R of the digital image data after white balance adjustment, G, and B into AWB evaluation value. The above-mentioned white balance adjustment part is provided with R for adjusting the gain of R and B, and the multiplier for B, a gain will be set as this multiplier of R and B by the control section 201, and white balance adjustment will be performed. The graphical-data-compression expansion circuit 107 performs Huffman encoding and quantization, inverse quantization, reverse Huffman encoding, etc. it is [Huffman encoding] as passing away of the orthogonal transformation and inverse orthogonal transformation it is [inverse orthogonal transformation], for example as passing away of the graphical data

compression and extension of JPEG conformity, and the graphical data compression and extension of JPEG conformity.
[0028]The data storage memory 401 is because it consists of PC cards and the image data by which compression processing was carried out is stored for example.
[0029]The control section 201 consists of CPU, ROM, RAM, etc. which are not illustrated, and this CPU, According to the program stored in ROM, RAM is used as workspace, and all the operations inside the above-mentioned digital camera are controlled according to external operation directions of the remote control etc. which are not directed or illustrated from the camera operation part 202. Specifically, the control section 201 controls imaging operation, white balance (AWB) adjusting operation, a stroboscope drive, etc. Motor Driver 109 drives a lens unit (the lens 101, mechanism mechanism 102 grade containing auto-focusing (AF), a diaphragm, and a filter part) based on the control signal from the control section 201. Although the strobe device 111 is mentioned later for details, it emits a strobe light (flash) based on the control signal from the control section 201.
[0030]The camera operation part 202 is for performing directions of a digital camera of operation, and is provided with the button for performing from the outside various setting out of a mode selection key (selection of speed-light-photography mode, normal photographing mode, etc.), the release key which directs photography, and others. EEPROM203, the initial data (adjustment data is included) for the control section 201 to perform motion control of a digital camera is written in. OSD circuit 204 is for displaying the text etc. which are inputted from the control section 201 on the display 301.
[0031]LCD, LED, EL, etc. realize and the display 301 displays the image data which carried out elongation processing of the photoed digital image data and the compressed image data stored in the data storage memory 401.
[0032]Drawing 2 is a figure showing the concrete circuitry (embodiment 1) of the strobe device 111 of drawing 1. In the strobe device 111 shown in drawing 2, the strobe device has determined strobe light time. The light control circuit 500 which outputs an emission control signal to the emitting circuit 503 based on the emission stopping signal inputted from the emission starting signal inputted from the control section 201, and the receiver circuit 503 as this strobe device 111 is shown in drawing 2, The charge circuit 501 which charges a main capacitor based on the charging control signal inputted from the control section 201, Based on the emission control signal inputted from the strobe light pipe connected with the main capacitor in parallel with a main capacitor, and the light control circuit 500, The emitting circuit 502 which consists of a trigger switch (for example, IGBT) for turning on and off the impression to the strobe light pipe of the voltage charged by the main capacitor, It is ** constituted with the receiver circuit 503 provided with the detector circuit which consists of a comparator etc. which output an emission stopping signal to the light control circuit 500 when the catoptric light which the photo sensor which receives the catoptric light of a photographic subject, and the photo sensor concerned received was set to a predetermined level.
[0033]Drawing 3 is a figure showing the time characteristics of the voltage between terminals of a strobe light pipe (voltage between both ends). The one where arc tube terminal voltage is higher serves as a strobe light of a blue system, and the lower one serves as a reddish strobe light. Terminal tube voltage falls to from a luminescence start before the end of luminescence gradually, follows it, and the voltage between terminals

of a strobe light pipe falls to it steeply.
[0034]The strobe device 111 can set up the charge voltages of a main capacitor arbitrarily with the charging control signal from the control circuit 201. Therefore, the terminal tube voltage of the strobe light pipe at the time of a strobe light can be set up arbitrarily. Using this function, the luminescent color temperature of the strobe light at the time of each voltage between terminals is measured beforehand, and it stores as a strobe light pipe characteristics table (evaluation) showing the relation between the voltage between terminals of a strobe light pipe, and luminescent color temperature EEPROM203. At the time of a strobe light, an AWB control value is computed using this strobe light pipe characteristics table.
[0035]Next, the operation in connection with the AWB control in the above-mentioned digital camera 1 is explained. When a photograph is taken in speed-light-photography mode in the digital camera concerning this invention, That is, when taking a photograph by emitting a strobe light (flash) from the emitting circuit 502 of the strobe device 111, an AWB control value is computed based on AWB evaluation value and the shift amount of the color temperature of a flash, and a white balance is adjusted. Hereafter, the example of outline operation of the white balance adjustment in strobe light mode is explained concretely below. The following examples of operation explain the case where the strobe device 111 has determined strobe light time. That is, the strobe device 111 measured the catoptric light of the strobe light, and has stopped luminescence of a strobe light in the place which reached a certain constant rate.
[0036]When speed-light-photography mode is chosen by the alter operation of the <of operation example 1> operator's camera operation part 202 and a release key is turned on, the control section 201, First, a charging control signal is outputted to the charge circuit 501 of the strobe device 111, and the charge circuit 501 starts charge of a main capacitor, then the control section 201 outputs an emission starting signal to the light control circuit 500 of the strobe device 111. The light control circuit 500 outputs the emission control signal for turning on the trigger switch of the emitting circuit 502 to the gate of the trigger switch of the emitting circuit 502. If an emission control signal is outputted, the control section 201 will set a timer to ON, in order to measure time to energize in a strobe light pipe. And the trigger switch of the emitting circuit 502 is set to ON, the voltage charged by the main capacitor is impressed among the both ends of a strobe light pipe, and a strobe light (flash) is emitted towards a photographic subject from a strobe light pipe.
[0037]On the other hand, the photosensor of the receiver circuit 503 receives the catoptric light from a photographic subject, and the detector circuit outputs an emission stopping signal to the light control circuit 500, when the catoptric light which the photo sensor received is set to a predetermined level. Thereby, the light control circuit 500 suspends the output of the emission control signal currently outputted to the gate of the trigger switch of the emitting circuit 502. The control section 201 will measure the time energized in the strobe light pipe by setting a timer to OFF, if an emission control signal is stopped.
[0038]And the control section 201 refers to the strobe light pipe characteristics table stored in EEPROM203, The shift amount of the color temperature of a flash is computed from the time energized in the strobe light pipe, The gain which should be set as the multiplier of R and B of an AWB control value, i.e., the white balance adjustment part of

a digital signal processing circuit, based on the shift amount of the color temperature of a flash and the AWB evaluation value of each color of RGB which were computed is determined, and it is set as this multiplier of R and B. It may decide to use the AWB evaluation value outputted to the control section 201 from the digital signal processing circuit 106 as AWB evaluation value at the time of the last photography.

[0039]Continue, and the control section 201 sends out an image taking indication signal to Timing SG110, and by this, The electrical signal (analog image data) according to a photographic subject is outputted from CCD103, and it is low-noise-ized in the CDS (correlation double sampling) circuit 104, and an A/D conversion is carried out with A/D converter 105, and digital image data is outputted to the digital signal processing circuit 106. And the digital image data in which white balance adjustment was carried out in the white balance adjustment part of the digital signal processing circuit 106 is once stored in the frame memory 108. And in the digital signal processing circuit 106, it separates into a color-difference signal (Cb, Cr) and a luminance signal (Y), and the digital image data once stored in the frame memory 108 is outputted to the graphical-data-compression expansion circuit 107. In the graphical-data-compression expansion circuit 107, compression processing of the digital image data (a color-difference signal (Cb, Cr) and a luminance signal (Y)) is carried out, and the compressed image data obtained is stored in the data storage memory 401.

[0040]According to the above-mentioned example 1 of operation, the time energized in speed-light-photography mode in the strobe light pipe which emits the flash of the strobe device 111 is measured, The shift amount of the color temperature of a flash is computed by computing the amount of changes of potential impressed to the arc tube concerned based on the energized time concerned, Since an AWB control value is computed based on this shift amount and AWB evaluation value of a color temperature of a flash that were computed and white balance adjustment is performed based on the AWB control value concerned, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly.

[0041]When speed-light-photography mode is chosen by the alter operation of the <of operation example 2> operator's camera operation part 203 and a release key is turned on, the control section 201, First, a charging control signal is outputted to the charge circuit 501 of the strobe device 111, and the charge circuit 501 starts charge of a main capacitor, then the control section 201 outputs an emission starting signal to the light control circuit 500 of the strobe device 111. The light control circuit 500 outputs the emission control signal for turning on the trigger switch of the emitting circuit 502 to the gate of the trigger switch of the emitting circuit 502. Thereby, the trigger switch of the emitting circuit 502 is set to ON, the voltage charged by the main capacitor is impressed among the both ends of a strobe light pipe, and a strobe light (flash) is emitted towards a photographic subject from a strobe light pipe.

[0042]On the other hand, the photosensor of the receiver circuit 503 receives the catoptric light from a photographic subject, and the detector circuit of the receiver circuit 503 outputs an emission stopping signal to the light control circuit 500, when the catoptric light which the photo sensor received is set to a predetermined level. Thereby, the light control circuit 500 suspends the output of the emission control signal currently outputted to the gate of the trigger switch of the emitting circuit 502. In the meantime, the voltage

detector which is not illustrated detects the voltage between both ends at the time of the luminescence start of a strobe light pipe, and the end of luminescence.
[0043]And the control section 201 refers to the strobe light pipe characteristics table stored in EEPROM203 based on the difference of the voltage between both ends at the time of the luminescence start of a strobe light pipe, and the end of luminescence, Compute the shift amount of the color temperature of a flash and based on the shift amount of the color temperature of a flash and the AWB evaluation value of each color of RGB which were computed An AWB control value, That is, the gain which should be set as the multiplier of R and B of the white balance adjustment part of a digital signal processing circuit is computed, and the computed gain is set as the multiplier of R and B. It may decide to use the AWB evaluation value outputted to the control section 201 from the digital signal processing circuit 106 as AWB evaluation value at the time of the last photography.
[0044]Continue, and the control section 201 sends out an image taking indication signal to Timing SG110, and by this, The electrical signal (analog image data) according to a photographic subject is outputted from CCD103, and it is low-noise-ized in the CDS (correlation double sampling) circuit 104, and an A/D conversion is carried out with A/D converter 105, and digital image data is outputted to the digital signal processing circuit 106. And the digital image data in which white balance adjustment was carried out in the white balance adjustment part of the digital signal processing circuit 106 is once stored in the frame memory 108. And in the digital signal processing circuit 106, it separates into a color-difference signal (Cb, Cr) and a luminance signal (Y), and the digital image data once stored in the frame memory 108 is outputted to the graphical-data-compression expansion circuit 107. In the graphical-data-compression expansion circuit 106, compression processing of the digital image data (a color-difference signal (Cb, Cr) and a luminance signal (Y)) is carried out, and the compressed image data obtained is stored in the data storage memory 401.
[0045]According to the above-mentioned example 2 of operation, in speed-light-photography mode, the voltage between both ends of the strobe light pipe which emits the flash of the strobe device 111 at the time of a luminescence start and the end of luminescence is measured, Based on the difference of the voltage between both ends at the time of the measured luminescence start concerned and the end of luminescence, Since the shift amount of the color temperature of a flash is computed, an AWB control value is computed based on this shift amount and AWB evaluation value of a color temperature of a flash that were computed and white balance adjustment is performed based on the AWB control value concerned, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly.
[0046](Embodiment 2) Since the digital camera concerning Embodiment 2 is realizable by the same block configuration as the digital camera (embodiment 1) shown by above-mentioned drawing 1, explanation of the portion which has an equivalent function and composition is omitted. In Embodiment 2, the distance detecting means which detects the distance to a photographic subject by a lens unit (the lens 101, mechanism mechanism 102), CCD103, Motor Driver 109, and control-section 201 grade is constituted. Although the distance detecting means can compute the distance to a photographic subject by a publicly known method (for example, distance detecting method of the digital still

camera indicated to JP,7-301842,A) and detailed explanation is omitted, For example, based on the spatial frequency of the picture signal at the time of driving the lens 101, the distance to a photographic subject is computable.

[0047]Drawing 4 is a figure showing the concrete circuitry (embodiment 2) of the strobe device 111 of drawing 1. In the strobe device 111 shown in drawing 4, it is CPU of the control circuit 201 and has decided on strobe light time. The light control circuit 600 which outputs an emission control signal to the emitting circuit 603 based on the emission starting signal and emission stopping signal which are inputted from the control section 201 as this strobe device 111 is shown in drawing 4, The charge circuit 601 which charges a main capacitor based on the charging control signal inputted from the control section 201, Based on the emission control signal inputted from the strobe light pipe connected with the main capacitor in parallel with a main capacitor, and the light control circuit 600, It has the emitting circuit 602 which consists of a trigger switch (for example, IGBT) for turning on and off the impression to the strobe light pipe of the voltage charged by the main capacitor, and the receiver circuit 603 which receives the catoptric light of a photographic subject with a photo sensor, and is outputted to the control section 201.

[0048]Next, the operation in connection with the AWB control in the digital camera 1 concerning this Embodiment 2 is explained. When a photograph is taken in speed-light-photography mode in the digital camera concerning this embodiment, That is, when taking a photograph by emitting a strobe light (flash) from the emitting circuit 602 of the strobe device 111, an AWB control value is computed based on AWB evaluation value and the shift amount of the color temperature of a flash, and a white balance is adjusted. The example of outline operation of the white balance adjustment in strobe light mode is explained below. In the following examples of operation, CPU of the control circuit 201 explains the case where the emission time of a stroboscope is determined.

[0049]If speed-light-photography mode is chosen by the alter operation of the <of operation example 3> operator's camera operation part 202 and a release key is turned on, a distance detecting means will detect the distance to a photographic subject. The control section 201 decides on strobe light time based on the detected distance data. And the control section 201 refers to the strobe light pipe characteristics table stored in EEPROM203, The shift amount of the color temperature of a flash is computed from this strobe light time on which it decided, The gain which should be set as the multiplier of R and B of an AWB control value, i.e., the white balance adjustment part of the digital signal processing circuit 106, based on the shift amount of the color temperature of a flash and the AWB evaluation value of each color of RGB which were computed is computed, and the computed gain is set as the multiplier of R and B. It may decide to use the AWB evaluation value outputted to the control section 201 from the digital signal processing circuit 106 as AWB evaluation value at the time of the last photography.

[0050]And a charging control signal is outputted to the charge circuit 601 of the strobe device 111 (refer to drawing 4), and the charge circuit 601 starts charge of a main capacitor, then the control section 201 outputs an emission starting signal to the light control circuit 600 of the strobe device 111. The light control circuit 600 outputs the emission control signal for turning on the trigger switch of the emitting circuit 602 to the gate of the trigger switch of the emitting circuit 602. According to this, the trigger switch of the emitting circuit 602 is set to ON, the voltage charged by the main capacitor among

the both ends of a strobe light pipe is impressed, and a strobe light is emitted towards a photographic subject from a strobe light pipe. And when it reaches at the above-mentioned strobe light time on which it decided, the control section 201 outputs an emission stopping signal to the light control circuit 600 of the strobe device 111, and stops luminescence of a strobe light pipe.

[0051]Continue, and the control section 201 sends out an image taking indication signal to Timing SG110, and by this, The electrical signal (analog image data) according to a photographic subject is outputted from CCD103, and it is low-noise-ized in the CDS (correlation double sampling) circuit 104, and an A/D conversion is carried out with A/D converter 105, and digital image data is outputted to the digital signal processing circuit 106. And the digital image data in which white balance adjustment was carried out in the white balance adjustment part of the digital signal processing circuit 106 is once stored in the frame memory 108. And in the digital signal processing circuit 106, it separates into a color-difference signal (Cb, Cr) and a luminance signal (Y), and the digital image data once stored in the frame memory is outputted to the graphical-data-compression expansion circuit 107. In the graphical-data-compression expansion circuit 107, compression processing of the digital image data (a color-difference signal (Cb, Cr) and a luminance signal (Y)) is carried out, and the compressed image data obtained is stored in a data storage memory.

[0052]According to the above-mentioned example 3 of operation, the distance to a photographic subject is measured in speed-light-photography mode, Based on the measured object distance concerned, it decides on the strobe light time of the strobe device 111, The shift amount of the color temperature of a flash is computed based on the strobe light time concerned, Since an AWB control value is computed based on this shift amount and AWB evaluation value of a color temperature of a flash that were computed and white balance adjustment is performed based on the AWB control value concerned, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly.

[0053]When speed-light-photography mode is chosen by the alter operation of the <of operation example 4> operator's camera operation part 202 and a release key is turned on, the control section 201 makes predetermined time and once pre luminescence perform to the strobe device 111. The control section 201 outputs a charging control signal to the charge circuit 601 of the strobe device 111 (refer to drawing 4), and the charge circuit 601 starts charge of a main capacitor, then, specifically, the control section 201 outputs an emission starting signal to the light control circuit 600 of the strobe device 111. The light control circuit 600 outputs the emission control signal for turning on the trigger switch of the emitting circuit 602 to the gate of the trigger switch of the emitting circuit 602. According to this, the trigger switch of the emitting circuit 602 is set to ON, the voltage charged by the main capacitor among the both ends of a strobe light pipe is impressed, and a strobe light is emitted towards a photographic subject from a strobe light pipe. On the other hand, the photosensor of the receiver circuit 603 receives the catoptric light from a photographic subject, and sends it out to the control section 201 as a light-receiving signal.

[0054]The control section 201 decides on strobe light time based on the quantity of the catoptric light which the receiver circuit 603 received. And the control section 201 refers

to the strobe light pipe characteristics table stored in EEPROM203, The shift amount of the color temperature of a flash is computed from this strobe light time on which it decided, The gain which should be set as the multiplier of R and B of an AWB control value, i.e., the white balance adjustment part of the digital signal processing circuit 106, based on the shift amount of the color temperature of a flash and the AWB evaluation value of each color of RGB which were computed is computed, and the computed gain is set as the multiplier of R and B. It may decide to use the AWB evaluation value outputted to the control section 201 from the digital signal processing circuit 106 as AWB evaluation value at the time of the last photography.

[0055]And a charging control signal is outputted to the charge circuit 601 of the strobe device 111, and the charge circuit 601 starts charge of a main capacitor, then the control section 201 outputs an emission starting signal to the light control circuit 600 of the strobe device 111. The light control circuit 600 outputs the emission control signal for turning on the trigger switch of the emitting circuit 602 to the gate of the trigger switch of the emitting circuit 602. According to this, the trigger switch of the emitting circuit 602 is set to ON, the voltage charged by the main capacitor among the both ends of a strobe light pipe is impressed, and a strobe light is emitted towards a photographic subject from a strobe light pipe. And when it reaches at the above-mentioned strobe light time on which it decided, the control section 201 outputs an emission stopping signal to the light control circuit 600 of the strobe device 111, and stops luminescence of a strobe light pipe.

[0056]Continue, and the control section 201 sends out an image taking indication signal to Timing SG110, and by this, The electrical signal (analog image data) according to a photographic subject is outputted from CCD103, and it is low-noise-ized in the CDS (correlation double sampling) circuit 104, and an A/D conversion is carried out with A/D converter 105, and digital image data is outputted to the digital signal processing circuit 106. And the digital image data in which white balance adjustment was carried out in the white balance adjustment part of the digital signal processing circuit 106 is once stored in the frame memory 108. And in the digital signal processing circuit 106, it separates into a color-difference signal (Cb, Cr) and a luminance signal (Y), and the digital image data once stored in the frame memory 108 is outputted to the graphical-data-compression expansion circuit 107. In the graphical-data-compression expansion circuit 107, compression processing of the digital image data (a color-difference signal (Cb, Cr) and a luminance signal (Y)) is carried out, and the compressed image data obtained is stored in the data storage memory 401.

[0057]According to the above-mentioned example 4 of operation, in speed-light-photography mode to a strobe device. Before luminescence of the flash for photography, make Puri luminescence perform and it decides on the strobe light time in the case of photography from the quantity of the catoptric light in the case of the Puri luminescence concerned, The shift amount of the color temperature of a flash is computed based on the strobe light time concerned, Since an AWB control value is computed based on this shift amount and AWB evaluation value of a color temperature of a flash that were computed and white balance adjustment is performed based on the AWB control value concerned, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly. It becomes possible to acquire the picture white balance adjustment was properly carried out also in speed-light-photography mode by the above operation of.

[0058]
[Effect of the Invention]In the imaging device provided with the speed-light-photography mode which takes a photograph by the imaging device concerning claim 1 emitting a flash with a strobe device, The image sensor which changes the object light through an optical system into an electrical signal, and is outputted as a color picture signal, The AWB evaluation methods which output the luminance data of each color of a color picture signal as AWB evaluation value, In a white balance adjustment means to perform white balance adjustment of at least 2 colors of a color picture signal, the color temperature calculating means which computes the shift amount of the color temperature of a flash in said speed-light-photography mode, and speed-light-photography mode, The white balance control means which computes an AWB control value based on the shift amount and said AWB evaluation value of a color temperature of the computed flash, controls said white balance adjustment means based on the AWB control value concerned, and performs white balance adjustment, Since it was considered as preparation ******, when taking a photograph by emitting a flash with a strobe device, even if the color temperature of a flash changes, it becomes possible to reproduce white properly. It becomes possible to acquire the picture white balance adjustment was properly carried out also in speed-light-photography mode by the above operation of.
[0059]In the imaging device concerning claim 1, the imaging device concerning claim 2 a color temperature calculating means, Since the time energized in the strobe light pipe which emits the flash of a strobe device is measured, the amount of changes of potential impressed to the strobe light pipe concerned is computed based on the energized time concerned and the shift amount of the color temperature of a flash is computed, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly. It becomes possible to acquire the picture white balance adjustment was properly carried out also in speed-light-photography mode by the above operation of.
[0060]In the imaging device concerning claim 1, the imaging device concerning claim 3 a color temperature calculating means, Based on the difference of the voltage between both ends at the time of the measured luminescence start concerned and the end of luminescence since the voltage between both ends of the strobe light pipe which emits the flash of the strobe device at the time of a luminescence start and the end of luminescence was measured and the shift amount of the color temperature of said flash is computed, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly. It becomes possible to acquire the picture white balance adjustment was properly carried out also in speed-light-photography mode by the above operation of.
[0061]In the imaging device concerning claim 1, the imaging device concerning claim 4 a color temperature calculating means, Based on the strobe light time concerned since the distance to a photographic subject was measured, it decided on the strobe light time of said strobe device based on the measured object distance concerned and the shift amount of the color temperature of said flash is computed, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly.
[0062]In the imaging device concerning claim 1, the imaging device concerning claim 5 a color temperature calculating means, Puri luminescence is made to perform to said strobe

device before luminescence of the flash for photography, Based on the strobe light time concerned since it decided on the strobe light time in the case of photography from the quantity of the catoptric light in the case of the Puri luminescence concerned and the shift amount of the color temperature of a flash is computed, When taking a photograph by emitting a flash with a strobe device by easy circuitry, even if the color temperature of a flash changes, it becomes possible to reproduce white properly.

[0063]In the imaging device of any one statement of claim 1-5, the imaging device concerning claim 6 a white balance adjustment means, The gain of a color picture signal is adjusted, and since it presupposed the white balance control means that a gain is set up based on an AWB control value, easy circuitry enables it to perform white balance adjustment.

[0064]In the imaging device of any one statement of claim 1-5, since the imaging device concerning claim 7 presupposed the strobe device that the voltage between terminals of a strobe light pipe can be set up arbitrarily, it becomes possible to set up the coloring color temperature of a strobe light pipe arbitrarily.

[0065]In the imaging device of any one statement of claim 1-5 the imaging device concerning claim 8, Have a memory measure which memorizes the strobe light pipe characteristics table showing the relation between the voltage between both ends of a strobe light pipe, and luminescent color temperature, and a white balance control means, Since white balance adjustment is performed with reference to a strobe light pipe characteristics table, it becomes possible to perform white balance adjustment easily.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a lineblock diagram of the digital camera concerning Embodiment 1.

[Drawing 2]It is a figure showing the concrete circuitry of the strobe device of drawing 1.

[Drawing 3]It is a schematic diagram of the change of potential between strobe light terminals to the emission time of a stroboscope.

[Drawing 4]It is a figure showing the concrete circuitry of the strobe device concerning Embodiment 2.

[Description of Notations]

1 Digital camera

100 Picture image pick-up part
101 Lens
102 Mechanism mechanism
103 CCD
104 CDS circuit
105 A/D converter
106 Digital signal processing circuit
107 Graphical-data-compression signal circuit
108 Frame memory
109 Motor Driver
110 TimingSG (control signal generation)
111 Strobe device
200 Camera operation part
201 Control section
202 Camera operation part
203 EEPROM
204 OSD circuit
300 Indicator
301 Display
400 Data recording part
401 Data storage memory
500 Light control circuit
501 Charge circuit
502 Emitting circuit
503 Receiver circuit
600 Light control circuit
601 Charge circuit
602 Emitting circuit
603 Receiver circuit

[Translation done.]
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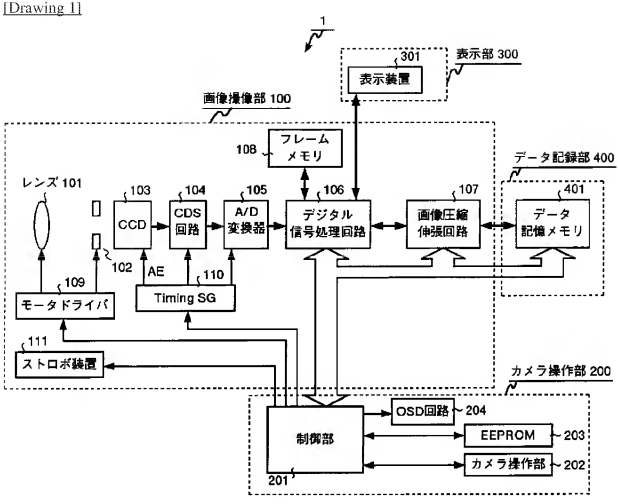
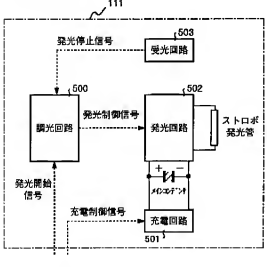
DRAWINGS

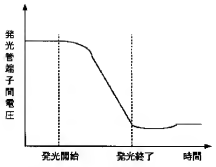
[Drawing 1]



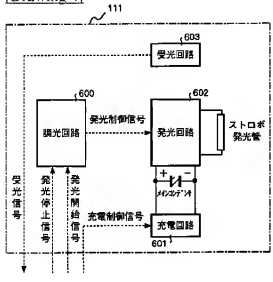
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]